**Plate movement lab**

Name: Date:

Block:

**Purpose:**

What causes this continuous motion of the continental plates? Convection currents are believed to be the driving force behind plate tectonics. In this activity, you will observe convection currents in a liquid and make connections between your observations and the motions within the mantleand examine how the placement of heat sources and number of heat sources could affect the pattern of convection currents.

**Introduction:**

**Convection currents**

This hypothesis suggests that flow in the mantle is induced by **convection currents** which drag and move the lithospheric plates above the astenosphere. Convection currents rise and spread below divergent plate boundaries and converge and descend along convergent.

What is the cause of plate movement? Not all geologists agree on an answer, but most feel the key is understanding what happens in the asthenosphere. They believe that as the asthenosphere moves and flows, the lithospheric plates are carried along for the ride. Convection currents are responsible for the movement of tectonic plates on the crust of the Earth. Convection occurs because density of a fluid is related to its temperature. Hot rocks lower in the mantle are less dense than their cooler counterparts above. The hot rock rises and the cooler rock sinks due to gravity, resulting in the circular movement of currents in the asthenosphere, moving the lithospheric plates, which cause the plates of the crust to move. In some cases the plates push into one another causing mountains and in other cases, the plates pull apart causing mid-ocean ridges deep in the ocean.

**Materials**

5 Foam cups

Plastic Container

Room Temperature Water

Hot Water

Beaker

Dropper

Food Coloring in test tube

**Procedure:**

**Trial 1 –the control**

1. Fill your plastic shoebox with cold tap water
2. Add a few drops of food coloring to the bottom of the middle of the container of liquid.
3. Observe and record what happens for **two minutes.**
4. Describe your result (in YOUR OWN WORDS) and draw a side view of the

container to show what happened in the chart. Use arrows to show any movement of the food coloring.

1. Once step 4 is completed, use a spoon to swirl the liquid and disperse the food coloring.

**Trial 2-one central heat source**

1. Fill up one of the Styrofoam cups with hot water from the coffee urn.
2. Carefully slide the cup underneath the plastic shoebox so that it is under the center of the container.
3. Carefully add a few drops of food coloring on the bottom of the container directly above the cup of hot water.
4. Observe the movement for the next 7 minutes or as much time is needed to see a full convection cycle (full circles).
5. sketch your results using arrows for movement of the coloring and describe what you saw in your own words.
6. Save the cup of hot water for the next step.
7. Swirl the liquid in the container to disperse the coloring (if the liquid is too

colored you may want to empty it and add new tap water)

**Trial 3—two central heat sources**

1. Grab another hot cup of water from the coffee urn
2. Place each hot cup of water at the very far ends of the plastic box, so that they are as far away as possible
3. Carefully add a few drops of food coloring in the middle of the bottom of the

container (as far away from the heat sources as possible).

1. Observe the movement for the next 7 minutes or as much time is needed to see a full convection cycle (full circles)
2. Sketch your results using arrows for movement of the coloring and describe what you saw in your own words.
3. Carefully add a few pieces of Styrofoam. And watch where they go. You will

talk about this result in the conclusions

1. Swirl the liquid in the container to disperse the coloring (if the liquid is too

colored you may want to empty it and add new tap water). Pull out the styrofoam pieces.

**Trial 4- your own design**

1. Try something you haven’t tried before. You can move the placement of the

sources,(cups) change the number of sources or change the temperatures of what is involved.

1. Describe what you will do.

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1. Predict what will happen:

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| TRIAL 1 Side view Diagram | Trial 1 Description of results |
| TRIAL 2 --- Side view Diagram | Trial 2 Description of results: |
| TRIAL 3 --- Side view diagram | Trial 3 Description of results: |
| TRIAL 4 --- Side view diagram | Trial 4 --- Description of results: |

**Conclusions Part I**---Write **complete sentences**

1. Today you were looking at the potential cause of motions in the mantle.

What wasthe variable being tested in the trials?

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1. Compare the results of trial 1 (the control) to trials 2 and trial 3. Then explain

why was it important to perform a control.

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1. (A) What happened to the colored water in trial 3 in the region between the two heat sources?

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(B)How did the How did the colored water move as it moved away from the

heat sources?

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1. Explain the movement of the colored water in places in terms of its changes in

temperature and what happens to its density. Be specific here.

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1. This activity models a process that many geologists think might be the driving

force behind plate tectonics. In this model what did each of the following

represent:

1. The water in the box? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The cups of hot water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. The Styrofoam pieces?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. On a separate sheet, write a two paragraph summary.

**In the first paragraph**

* write an explanation of how convection works in the mantle
* why convection currents make circular motions
* why stuff rises and why stuff sinks in terms of temperature and density).

**In your second paragraph**

* explain how well the models you made today simulated the forces behind plate tectonics.
* What was good about the model?
* What were the limitations? (re-read the introduction of the lab to help)

**Conclusions Part II**---Write **complete sentences**

1. This activity models a process that many geologists think might be the driving

force behind plate tectonics. We used different materials (box of water, cups of

hot water, Styrofoam pieces) to represent different things in the earth. In this

model we used\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to represent heat from the core. The

mantle was represented by\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the plates were represented by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. Today you were looking at what is the cause of motions in the mantle. What was

the *variable* (the thing you changed from one trial to another) being tested in the

trials?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

A control is an experiment that is designed to see what would happen if no

variables were involved. Why was it important to perform your control?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3. What happened to the colored water in trial 3 in the region between the two heat

sources?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How did the How did the colored water move as it moved away from the

heat sources?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Why did the colored water rise in some places---what happened to its temperature and its density?

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5.Why did the colored water sink in some places?

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What happened to its temperature and its density?

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6. Describe in **detail** how plates move and what happens in the mantle in your own

words (look back at the introduction paragraph to the lab to help you out.

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